Just-in-Time Lecture

Swine influenza A (H1N1) Outbreak in US & Mexico: Potential for a Pandemic

(Version 3, first JIT lecture issued April 26)

Tuesday, April 28, 2009

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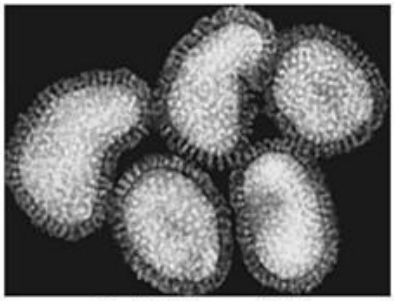
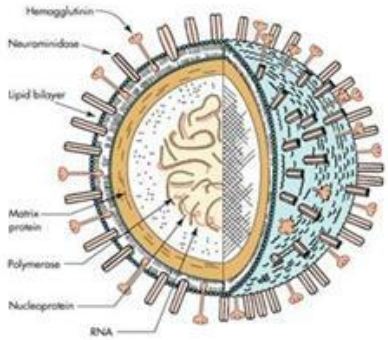
Virus

- RNA, enveloped
- Viral family: Orthomyxoviridae
- Size:
  80-200nm or .08 – 0.12 μm (micron) in diameter
- Three types
  - A, B, C
- Surface antigens
  - H (haemaglutinin)
  - N (neuraminidase)



Credit: L. Stammard, 1995



Haemagglutinin subtype					Neuraminidase subtype				
									
H1	✸	✸		✸	N1	✸	✸		✸
H2					N2				
H3					N3				
H4					N4				
H5					N5				
H6					N6				
H7					N7				
H8					N8				
H9					N9				
H10									
H11									
H12									
H13									
H14									
H15									
H16									

Definitions: *General*

- *Epidemic* – a located cluster of cases
- *Pandemic* – worldwide epidemic
- *Antigenic drift*
  - Changes in proteins by genetic point mutation & selection
  - Ongoing and basis for change in vaccine each year
- *Antigenic shift*
  - Changes in proteins through genetic reassortment
  - Produces different viruses not covered by annual vaccine

Swine Flu: *Introduction*

- Swine Influenza (swine flu) is a respiratory disease of pigs caused by type A influenza that regularly cause outbreaks of influenza among pigs
- Swine flu viruses do not normally infect humans, however, human infections with swine flu do occur, and cases of human-to-human spread of swine flu viruses has been documented
- Most commonly, human cases of swine flu happen in people who are around pigs but it's possible for swine flu viruses to spread from person to person also

Swine Flu: *History in US*

- A swine flu outbreak in Fort Dix, New Jersey, USA occurred in 1976 that caused more than 200 cases with serious illness in several people and one death
  - More than 40 million people were vaccinated
  - However, the program was stopped short after over 500 cases of Guillain-Barre syndrome, a severe paralyzing nerve disease, were reported
    - 30 people died as a direct result of the vaccination
- In September 1988, a previously healthy 32-year-old pregnant woman in Wisconsin was hospitalized for pneumonia after being infected with swine flu and died 8 days later.
- From December 2005 through February 2009, a total of 12 human infections with swine influenza were reported from 10 states in the United States

Swine Flu: *Current Situation in the US*

- Since March 2009, 50 of confirmed human cases of a new strain of swine influenza A (H1N1) virus infection in California, Kansas, New York City, Ohio and Texas have been identified most have recovered (one case required brief hospitalization); 5 suspected cases in New Jersey
- All have the same genetic pattern based on preliminary testing
- Virus is being described as a new subtype of A/H1N1 not previously detected in swine or humans
- Samples from the Mexico outbreak match swine influenza isolates from patients in the United States

Source: CDC

Swine Flu: *Current Situation in the US*

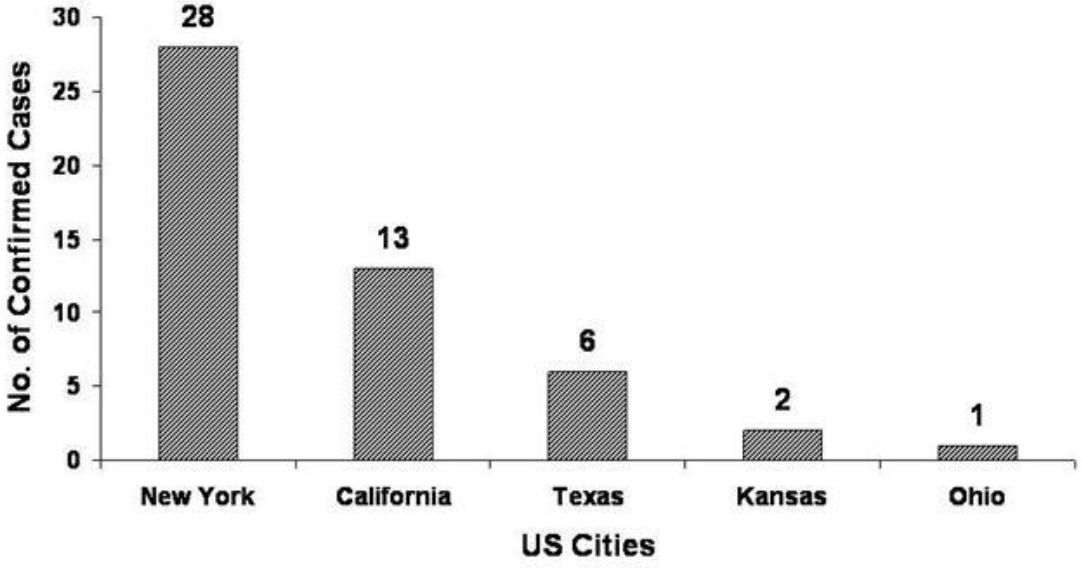
- CDC has determined that this virus is contagious and is spreading from human to human
- The virus contains gene segments from 4 different influenza types:
  - North American swine,
  - North American avian,
  - North American human, and
  - Eurasian swine
- The Strategic National Stockpile (SNS) is releasing one-quarter of its
  - anti-viral drugs
  - Personal protective equipment and
  - Reparatory protection devices

Source: CDC

Swine Flu: *US Human Cases*

As of April 28, 2009

Total Number of Confirmed Cases = 50 (no fatalities)



Source: CDC

Geospatial Distribution of Confirmed Cases in Canada, US and Mexico

Swine Flu: *Current Situation in Mexico*

- A total of approximately 2000 suspected cases have been reported in 19 of 32 States in Mexico with 152 deaths
  - 20 Laboratory confirmed
- First case in Oaxaca, April 13, 2009
  - Woman died of pneumonia
- Mexico City: Over 854 cases of pneumonia, 59 of them fatal
- San Luis Potosi: 24 cases with 3 deaths
- Mexicali (near the US border): 4 cases with no deaths
- The illness outbreak in Mexico City prompted the country's health minister to cancel classes in Mexico City and advised students and adults to avoid crowded public places and large events

Source: WHO, CDC & ProMED

Swine Flu: *Current Situation in Mexico*

- The virus in Mexico has primarily struck otherwise healthy young adults, (20-50 years) which is a departure from seasonal influenza, which typically affects the very young and very old
- CDC's laboratory analyzed 14 samples from severely ill Mexican patients and found that 7 of them had the same swine flu mix as the virus that infected the US patients (preliminary report)
- Canada's national laboratory has confirmed swine flu A/H1N1 in 18 isolates from Mexican patients, 12 of which were genetically identical to the swine flu viruses from California
- The WHO raised the alert level to Phase 4, meaning there is sustained human-to-human transmission of the virus causing outbreaks in at least one country
- Its alert system was revised after Avian influenza began to spread in 2004, and Monday was the first time it was raised above Phase 3.

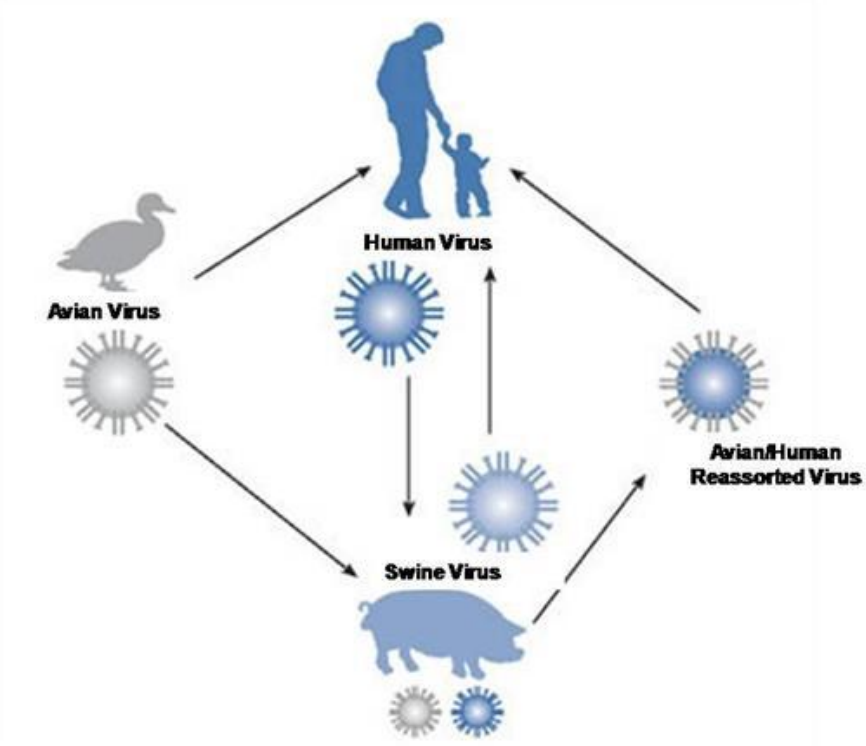
Source: WHO, CDC & ProMED

Swine Flu: *Current Situation Globally*

Worldwide 82 confirmed cases, 152 deaths (Mexico only)

- USA: 50 confirmed, 5 suspected in New Jersey
- Mexico: 20 confirmed
- Canada: 06 confirmed cases (British Columbia 2; Nova Scotia 4)
- Scotland: 02 confirmed cases
- New Zealand: 03, confirmed, 22 suspected cases
- Spain: 01 has confirmed & 5 suspected cases
- Columbia: 12 suspected cases
- Italy: 01 suspected case
- Brazil: 01 suspected case
- Israel: 01 suspected case
- Australia: 02 suspected cases, tested negative
- France: 04 suspected cases, tested negative
- England: 01 suspected case, ruled out
- European Union (EU) Health Commissioner Androulla Vassiliou issued a travel advisory to the 27 EU member countries recommending that "non-essential" travel to affected parts of the U.S. and Mexico be suspended

Swine Flu: *Transmission Through Species Reassortment in Pigs*



Swine Flu: *Transmission to Humans*

- Through contact with infected pigs or environments contaminated with swine flu viruses
- Through contact with a person with swine flu
- Human-to-human spread of swine flu has been documented also and is thought to occur in the same way as seasonal flu, through coughing or sneezing of infected people
- People with swine influenza virus infection should be considered potentially contagious as long as they are symptomatic and possible for up to 7 days following illness onset
- Children, especially younger children, might potentially be contagious for longer periods

Swine Flu: *US Case Definitions*

- A *confirmed case* of swine influenza A (H1N1) virus infection is defined as a person with an acute respiratory illness with laboratory confirmed swine influenza A (H1N1) virus infection at CDC by one or more of the following tests:
  - real-time RT-PCR
  - viral culture
  - four-fold rise in swine influenza A (H1N1) virus-specific neutralizing antibodies
- A *suspected case* of swine influenza A (H1N1) virus infection is defined as a person with acute febrile respiratory illness with onset within 7 days of close contact with a person who is a confirmed case of swine influenza A (H1N1) virus infection
- *Close contact* is defined as: within about 6 feet of an ill person who is a confirmed or suspected case of swine influenza A (H1N1) virus infection
- *Acute respiratory illness* is defined as recent onset of at least two of the following: rhinorrhea or nasal congestion, sore throat, cough (with or without fever or feverishness)
- Clinicians should consider swine influenza A (H1N1) virus infection in the differential diagnosis of patients with febrile respiratory disease and who
  - 1) live in San Diego and Imperial Counties, California, or Guadalupe County, Texas, or traveled to these counties or
  - 2) who traveled recently to Mexico or were in contact with persons who had febrile respiratory illness and were in the two U.S. counties or Mexico in the 7 days preceding their illness onset

Source: CDC

Swine Flu: *Guidelines for Clinicians*

- Clinicians should consider the possibility of swine influenza virus infections in patients presenting with febrile respiratory illness who
  - live in areas where human cases of swine influenza A (H1N1) have been identified or
  - have traveled to an area where human cases of swine influenza A (H1N1) has been identified or
  - Have been in contact with ill persons from these areas in the 7 days prior to their illness onset

- If swine flu is suspected, clinicians should obtain a respiratory swab for swine influenza testing and place it in a refrigerator (not a freezer)
  - Once collected, the clinician should contact their state or local health department to facilitate transport and timely diagnosis at a state public health laboratory

Source: CDC

Swine Flu: *Biosafety Guidelines for Laboratory Workers*

- Diagnostic work on clinical samples from patients who are suspected cases of swine influenza A (H1N1) virus infection should be conducted in a BSL-2 laboratory
  - All sample manipulations should be done inside a biosafety cabinet (BSC)
- Viral isolation on clinical specimens from patients who are suspected cases of swine influenza A (H1N1) virus infection should be performed in a BSL-2 laboratory with BSL-3 practices (enhanced BSL-2 conditions)
- Additional precautions include:
  - recommended personal protective equipment (based on site specific risk assessment)
  - respiratory protection - fit-tested N95 respirator or higher level of protection
  - shoe covers
  - closed-front gown
  - double gloves
  - eye protection (goggles or face shields)
- Waste
  - all waste disposal procedures should be followed as outlined in your facility standard laboratory operating procedures

Source: CDC

Swine Flu: *Biosafety Guidelines for Laboratory Workers*

- Appropriate disinfectants
  - 70 per cent ethanol
  - 5 per cent Lysol
  - 10 per cent bleach
- All personnel should self monitor for fever and any symptoms. Symptoms of swine influenza infection include diarrhea, headache, runny nose, and muscle aches
- Any illness should be reported to your supervisor immediately
- For personnel who had unprotected exposure or a known breach in personal protective equipment to clinical material or live virus from a confirmed case of swine influenza A (H1N1), antiviral chemoprophylaxis with zanamivir or oseltamivir for 7 days after exposure can be considered

Source: CDC

Swine Flu: *Guidelines for General Population*

- Covering nose and mouth with a tissue when coughing or sneezing
  - Dispose the tissue in the trash after use.
- Handwashing with soap and water
  - Especially after coughing or sneezing.
- Cleaning hands with alcohol-based hand cleaners
- Avoiding close contact with sick people
- Avoiding touching eyes, nose or mouth with unwashed hands
- If sick with influenza, staying home from work or school and limit contact with others to keep from infecting them

Source: CDC

Swine Flu: *Treatment*

- No vaccine available
- Antivirals for the treatment and/or prevention of infection:
  - Oseltamivir (Tamiflu) or
  - Zanamivir (Relenza)
- Use of anti-virals can make illness milder and recovery faster
- They may also prevent serious flu complications
- For treatment, antiviral drugs work best if started soon after getting sick (within 2 days of symptoms)
- Warning! Do *NOT* give aspirin (acetylsalicylic acid) to children or teenagers who have the flu; this can cause a rare but serious illness called Reye's syndrome

Swine Flu: *Other Protective Measures*

Defining Quarantine vs. Isolation vs. Social-Distancing

- *Isolation*: Refers only to the sequestration of *symptomatic* patents either in the home or hospital so that they will not infect others
- *Quarantine*: Defined as the separation from circulation in the community of *asymptomatic* persons that may have been exposed to infection
- *Social-Distancing*: Has been used to refer to a range of non-quarantine measures that might serve to reduce contact between persons, such as, closing of schools or prohibiting large gatherings

Swine Flu: *Other Protective Measures*

Personnel Engaged in Aerosol Generating Activities

- CDC Interim recommendations:
  - Personnel engaged in aerosol generating activities (e.g., collection of clinical specimens, endotracheal intubation, nebulizer treatment, bronchoscopy, and resuscitation involving emergency intubation or cardiac pulmonary resuscitation) for suspected or confirmed swine influenza A (H1N1) cases should wear a fit-tested disposable N95 respirator
  - Pending clarification of transmission patterns for this virus, personnel providing direct patient care for suspected or confirmed swine influenza A (H1N1) cases should wear a fit-tested disposable N95 respirator when entering the patient room
  - Respirator use should be in the context of a complete respiratory protection program in accordance with Occupational Safety and Health Administration (OSHA) regulations. Information on respiratory protection programs and fit test procedures can be accessed at www.osha.gov/SLTC/etools/respiratory
    - Staff should be medically cleared, fit-tested, and trained for respirator use, including: proper fit-testing and use of respirators, safe removal and disposal, and medical contraindications to respirator use

Swine Flu: *Other Protective Measures*

Infection Control of Ill Persons in a Healthcare Setting

- Patients with suspected or confirmed case-status should be placed in a *single-patient room* with the door kept closed. If available, an airborne infection isolation room (AIIR) with negative pressure air handling with 6 to 12 air changes per hour can be used. Air can be exhausted directly outside or be recirculated after filtration by a high efficiency particulate air (HEPA) filter. For suctioning, bronchoscopy, or intubation, use a procedure room with negative pressure air handling.
- The *ill person should wear a surgical mask when outside of the patient room*, and should be encouraged to wash hands frequently and follow respiratory hygiene practices. Cups and other utensils used by the ill person should be washed with soap and water before use by other persons. Routine cleaning and disinfection strategies used during influenza seasons can be applied to the environmental management of swine influenza. More information can be found at http://www.cdc.gov/ncidod/dhqp/gl_environinfection.html
- *Standard, Droplet and Contact precautions should be used* for all patient care activities, and maintained for 7 days after illness onset or until symptoms have resolved. Maintain adherence to *hand hygiene by washing with soap and water or using hand sanitizer* immediately after removing gloves and other equipment and after any contact with respiratory secretions.
- Personnel providing care to or collecting clinical specimens from suspected or confirmed cases should *wear disposable non-sterile gloves, gowns, and eye protection* (e.g., goggles) to prevent conjunctival exposure.

Types of protective masks

- Surgical masks
  - Easily available and commonly used for routine surgical and examination procedures
- High-filtration respiratory mask
  - Special microstructure filter disc to flush out particles bigger than 0.3 micron. These masks are further classified:
    - oil proof
    - oil resistant
    - not resistant to oil
  - The more a mask is resistant to oil, the better it is
  - The masks have numbers beside them that indicate their filtration efficiency. For example, a N95 mask has 95% efficiency in filtering out particles greater than 0.3 micron under normal rate of respiration.
- The next generation of masks use Nano-technologywhich are capable of blocking particles as small as 0.027 micron.




Summary

- The WHO raised the alert level to Phase 4, meaning there is sustained human-to-human transmission of the virus causing outbreaks in at least one country
- 82 confirmed cases worldwide
- 152 deaths in Mexico only
- Otherwise healthy young adults, (20-50 years) have been affected by the disease
- No vaccine is available
- Anti-virals available:
  - Oseltamivir (Tamiflu) or
  - Zanamivir (Relenza)
- EU issued restriction on non-essential travel to US and Mexico
- US recommends avoiding non-essential travel to Mexico
- **Unanswered Question**
  - Why only Mexico has reported deaths